

What is claimed is:

*Sub A17* 1. In a digital communication system employing forward error control and having a decision-directed tracking loop with an adaptive element, a method for selectively updating the adaptive element, said method comprising the steps of:

- (a) generating an estimate of a data symbol from an output of the adaptive element;
- (b) computing an error signal from the estimate of the data symbol and the output of the adaptive element;
- (c) passing one or more estimates to a decision quality estimator which computes one or more decision quality indicators of estimates and generates a decision quality indicator dependent value; and
- (d) updating the adaptive element with the error signal based on the decision quality indicator dependent value.

2. The method of claim 1 wherein:  
 said decision quality estimator comprises a syndrome calculator; and  
 the decision quality indicator is a syndrome.

*Sub A17* 3. The method of claim 2 wherein the syndrome calculator performs the following steps:

- (i) a parity-check operation to compute one or more syndromes of estimates; and
- (ii) a transmission error detection operation over the syndromes contained in a window of shift registers;

said transmission error detection operation generating a syndrome dependent value.

4. The method of claim 3 wherein the transmission error detection operation is an inclusive 'NOR' operation.
5. The method of claim 3 wherein the window has a length equal to one.
6. The method of claim 3 wherein the window has a length that is a function of a forward error control code.
7. The method described in claim 1 wherein step (d) comprises the further steps of:
  - (i) multiplexing the error signal with an adaptation-disabling value; and
  - (ii) disabling the update when a transmission error is detected.
8. The method of claim 7 wherein the adaptation-disabling value is a zero value.
9. The method described in claim 1 wherein step (d) comprises the further steps of:

- (i) analyzing the decision quality indicator dependent value to determine if a transmission error has occurred; and
  - (ii) rejecting a tentative update if it is determined that a transmission error has occurred.
10. In a digital communication system employing forward error control and having a decision-directed tracking loop with an adaptive element, a method for selectively updating the adaptive element, said method comprising the steps of:
- (a) generating an estimate of a data symbol from an output of the adaptive element;
  - (b) computing an error signal from the estimate of the data symbol and the output of the adaptive element;
  - (c) determining if the estimate of the data symbol has one or more probable errors; and
  - (d) selectively disabling updates of the adaptive element with the error signal if a determination has been made that the estimate of the data symbol has a probable error.
11. The method of claim 10 wherein the adaptive element performs an equalization function.
12. The method of claim 10 wherein the adaptive element performs a timing recovery function.

13. The method of claim 10 wherein the adaptive element performs a carrier recovery function.
14. The method of claim 10 wherein the adaptive element performs an automatic gain control function.
15. In a communication system employing a forward error control code and an adaptive processor, a method for selectively updating the adaptive processor, the method comprising the steps of:
- (a) calculating a decision quality indicator of an estimate wherein the estimate is obtained from an output of an adaptive processor;
  - (b) calculating a signal error from the estimate and the output of the adaptive processor;
  - (c) determining if a sequence of decision quality indicators within a window contains at least one transmission error representative value; and
  - (d) disabling an update of the adaptive processor when a transmission error representative value is present within the window.
16. The method of claim 15 further comprising the step of:
- (e) enabling the update of the adaptive processor when the sequence of decision quality indicators within the window contains no transmission error representative value.

17. The method of claim 15 wherein the size of the window of step (c) is dependent on a forward error control code.
18. The method of claim 17 wherein the forward error control code is a block code and the size of the window of step (c) is set equal to the size of a block of information.
19. The method of claim 17 wherein the forward error control code is a convolutional code and the size of the window of step (c) is set equal to the constraint length of the convolutional code.
20. The method of claim 17 wherein the adaptive processor is based on a block update with a certain rate and wherein the size of the window is set proportional to the block update rate.
21. An apparatus for selectively updating an adaptive element of a communication system, the apparatus comprising:
  - (a) a quantizer for generating an estimate of a symbol from an output of the adaptive element;
  - (b) an error calculator for computing a difference between the output of the adaptive element and the estimate;
  - (c) a decision quality estimator for computing one or more decision quality indicators of estimates and

generating a decision quality indicator dependent value; and

- (d) an adaptation controller for controlling the updating of the adaptive element based on the decision quality indicator dependent value.

22. The apparatus of claim 21 wherein the adaptive element is an adaptive equalizer.
23. The apparatus of claim 21 wherein the adaptive element is a carrier recovery circuit.
24. The apparatus of claim 21 wherein the adaptive element is a timing recovery circuit.
25. The apparatus of claim 21 wherein the adaptive element is an automatic gain control circuit.
26. The apparatus of claim 21 wherein the decision quality estimator is a syndrome calculator.
27. The apparatus of claim 26 wherein the syndrome calculator comprises:
  - (i) a parity check calculator; and
  - (ii) an enable generator containing a window of shift-registers, the enable generator having an output based on a NOR operation performed over the contents of the window of shift-registers.

28. The apparatus of claim 21 wherein the adaptation controller comprises a multiplexer for multiplexing an error signal with an adaptation-disabling value, the adaptation controller having an output based on an output of the decision quality estimator.
29. An apparatus for selectively updating an adaptive element of a communication system, the apparatus comprising:
- (a) an estimation circuit for generating an estimate of a symbol from an output of the adaptive element;
  - (b) an error calculating circuit for computing a difference between the output of the adaptive element and the estimate;
  - (c) a transmission error estimation circuit for identifying probable errors in a symbol; and
  - (d) an adaptation controller for controlling the updating of the adaptive element based on the identification of the probable errors in the symbol.
30. The apparatus of claim 29 wherein the adaptive element is an adaptive equalizer.
31. The apparatus of claim 29 wherein the adaptive element is a carrier recovery circuit.

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